

4.11 Configuration Management

4.11.1 Introduction

Configuration Management (CM) is a formal system engineering (SE) management discipline. It is “a management process for establishing and maintaining consistency of a product’s performance, functional, and physical attributes with its requirements, design and operational information throughout its life.”¹ The discipline provides a structured approach to identify, control, and maintain the configuration of a system/product during its lifecycle. CM enables organizations to ensure the integrity of their products through all lifecycle phases.

CM is the application of good, repeatable business practices to deliver a product that meets customers’ needs and enables maintenance of the product until end of service. CM includes five fundamental practices: (1) plan CM process, (2) identify baseline elements, (3) manage approved baseline elements, (4) provide configuration status, and (5) verify and audit configuration. These practices, along with data management, must be applied appropriately to maximize the benefits that can be obtained through CM. Each practice has standard supporting tasks that can be tailored to meet needs. These tasks are iterative in nature, in that CM provides a closed-loop process for managing change. Figure 4.11-1 is the high-level CM process overview.

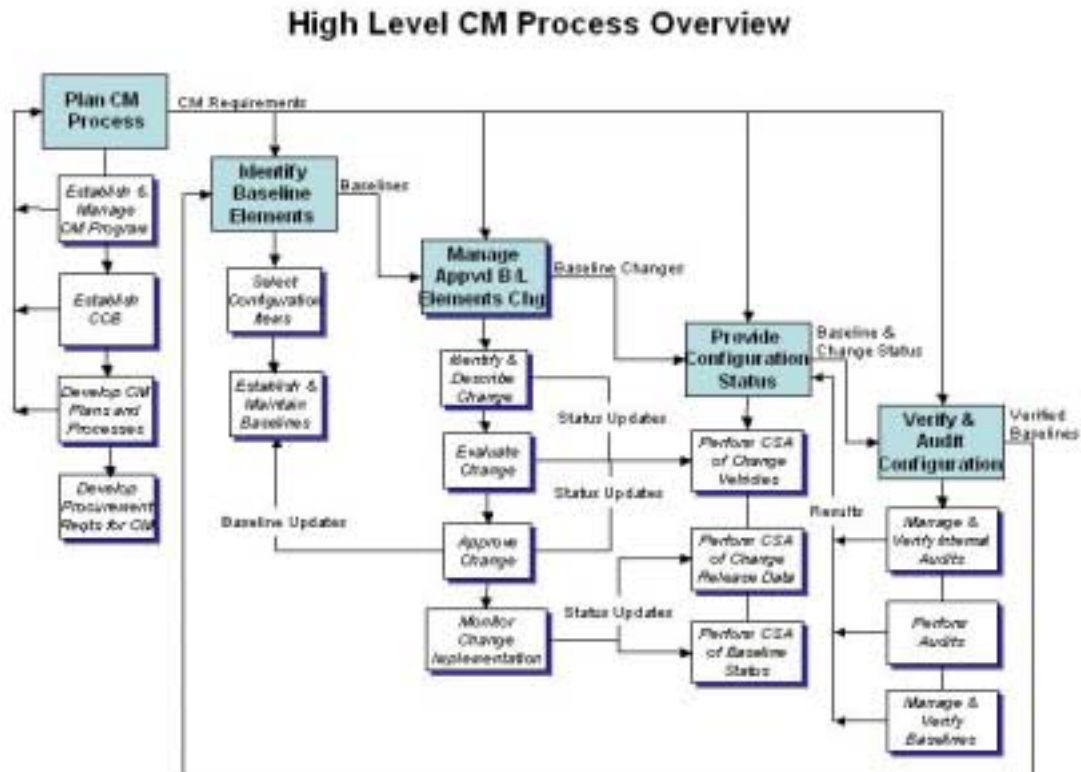


Figure 4.11-1. High-Level CM Process Overview

¹ ANSI/EIA-649-1998, National Consensus Standard for Configuration Management.

Applying CM to a product is progressive, which means that the initial concept of the product or service is documented, collaborated, and accepted. This adds further definition to the product as it moves through its lifecycle. Product definition is expressed through establishment and maintenance of baselines. The lifecycle phases discussed in this section are (1) concept exploration, (2) preliminary design, (3) detail design, (4) production, and (5) product operation. To support determination of how CM should be applied to a product, it is important to understand and plan accordingly for the product nature, complexity, the user, product environment and expected lifecycle.

To effectively manage a product through each of its lifecycle phases, good business practices, which support the fundamental practices discussed in this section, need to be in place. Business practices to conduct CM provide the means to plan and execute activities to reach the desired goals, which include delivering a quality product that meets the documented requirements, managing costs, meeting schedules, and enabling effective maintenance. These activities, when performed properly, provide a structured approach for managing systems and products throughout their lifecycles. Section 4.11.3 details the CM process tasks shown in Figure 4.11-1.

This section describes the fundamental principles of CM in the FAA. Details of how National Airspace System (NAS) CM is performed is defined and detailed through the Acquisition Management System (AMS); FAA Order 1800.66, National Airspace System Configuration Management Policy; and other related process documentation.

Formal CM of NAS products is established for the lifecycle of a system through inclusion of CM requirements and activities in accordance with the AMS required documentation; contract documentation such as the Statement of Work; and CM planning documentation. Designation of responsibility begins at the start of Solution Implementation, which is initiated by a Joint Resources Committee (JRC) Decision that includes assignment of responsibility. Responsibility includes establishing and maintaining a CM program for each product in accordance with FAA Order 1800.66. The rider includes guidance on developing CM plans, processes, and procedures and allows for tailoring of CM processes.

The activities described below comprise the practices for successfully performing NAS CM. The National CM Process is detailed in FAA Order 1800.66, Part Two, Section II, and should be used when tailoring processes to meet program needs. This tailoring may include the provision for performing change control outside the formal configuration control board, provided that the requirements for CM in FAA Order 1800.66 are met.

This section is organized as follows: the key NAS CM process inputs, both external and internal to the SE process; the NAS CM process tasks; and key NAS CM outputs. Figure 4.11-2 depicts the logical flow of information into and out of the NAS CM process.

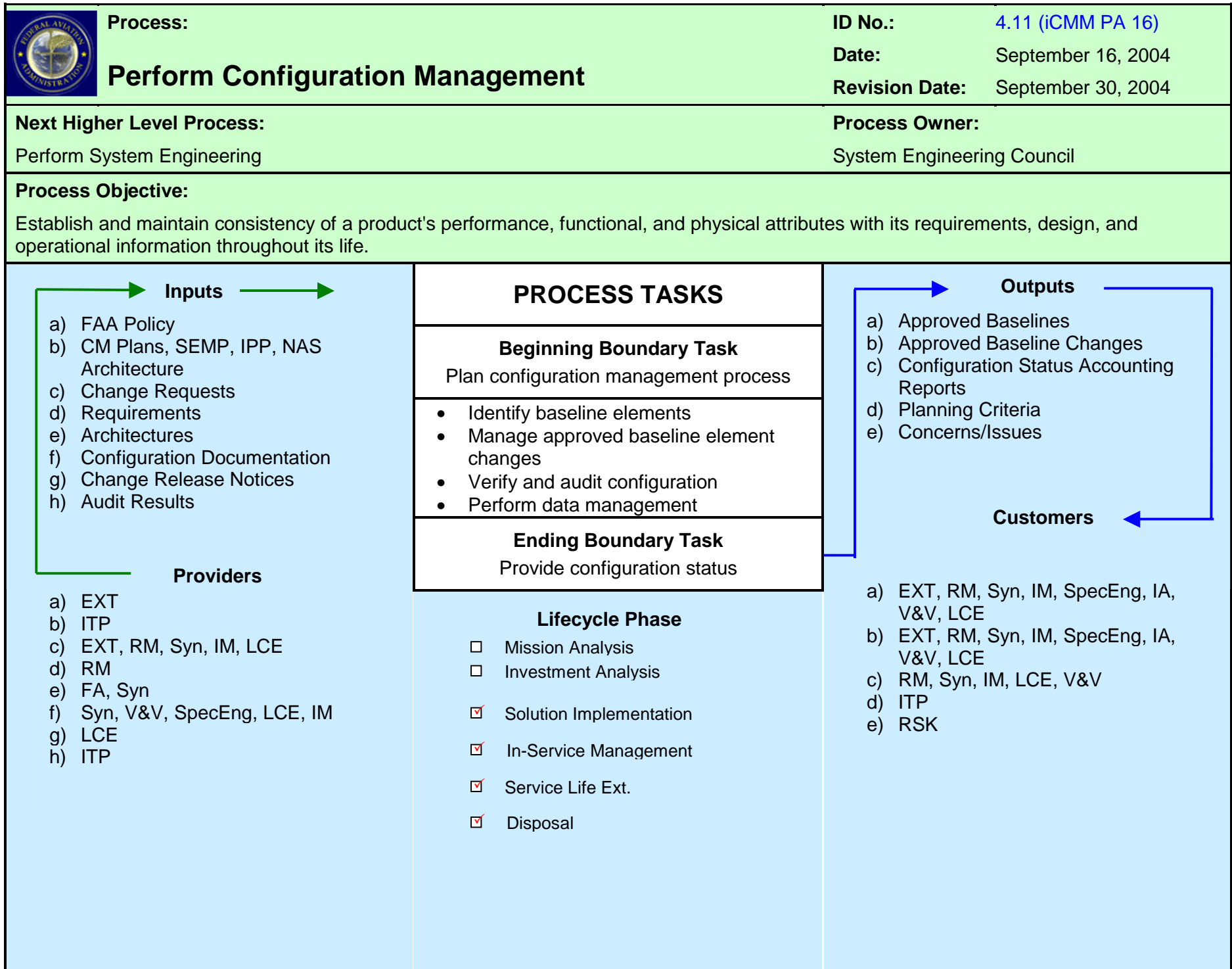


Figure 4.11-2. Configuration Management Process-Based Management Chart

4.11.2 Inputs

An input to CM is defined as information needed by the CM process that provides direction; is the basis for or otherwise drives CM process activities; or requires action through one or more CM task areas.

4.11.2.1 External

External inputs are defined as information provided to the CM process from outside the SE discipline process. Major external inputs to CM are detailed below.

4.11.2.1.1 FAA Policy

4.11.2.1.1.1 FAA Order 1800.66

CM policy, FAA Order 1800.66, prescribes the requirements and details the processes and procedures to perform CM of the NAS. The introduction of new products or services to the NAS or any changes to existing products or services must be accomplished in accordance with FAA Order 1800.66. This policy exists as a stand-alone document and as part of the FAA AMS.

4.11.2.1.1.2 Acquisition Management System

In addition to CM policy, the AMS also prescribes CM in other areas. These areas include developing CM criteria in the Integrated Program Plan.

4.11.2.1.2 Change Requests

4.11.2.1.2.1 Engineering Change Proposals (ECP)

ECPs are a change vehicle that contractors use to manage developmental baselines. ECPs require approval by the contractor's configuration control board (CCB). The contractor CCB is generally co-chaired by both the FAA and contractor representatives or, at a minimum, has FAA approval authority before implementation of the change.

4.11.2.1.2.2 Requests for Deviations and Waivers

During product development, there may be instances in which deviations or waivers to requirements are needed. The contractor will submit requests to deviate from or waive a specific requirement as applicable. Requests for deviation or waivers (RFW) are submitted by the contractor to the FAA for approval using the form(s) referenced in the agreed-upon CM plan or contract documentation.

4.11.2.1.2.3 Contractor Change Vehicles

Other contractor change vehicles affecting the change process must be documented in the contractor's/developer's approved CM plan.

4.11.2.1.2.4 Memoranda of Understanding

Memoranda of understanding (MOU) document the agreement made between FAA organizations or the FAA and an external organization. They may document a deviation in processes affecting standard or agreed-upon business practices or procedures,

approval authority, or technical agreements (such as external interfaces and data sharing). The CM process includes MOUs as source data to be kept as part of the program documentation and used as a means to drive, validate, and verify program activity as necessary.

4.11.2.2 Internal

Internal inputs are information provided to the CM process from within the SE discipline processes. Major internal inputs to CM are detailed below.

4.11.2.2.1 Integrated Technical Planning

4.11.2.2.1.1 Configuration Management Plans (CMP)

CMPs describe program CM strategy, implementation activities, and standard practices for performing CM within a program. The Integrated Technical Planning process (see Section 4.2) provides the strategy, activities, and practices for implementing CM within programs.

4.11.2.2.1.2 System Engineering Management Plan

The System Engineering Management Plan describes the SE work activity and the schedules associated with each task. Enterprise- level CM and related activity are captured and used by enterprise-level CM personnel to plan and execute activities affecting the SE processes.

4.11.2.2.1.3 Integrated Program Plan

The Integrated Program Plan documents the strategy for executing program activities and details how the program will be implemented.

4.11.2.2.1.4 NAS Architecture

The NAS Architecture is used as the basis for the overall baseline of what the NAS looks like today. It is the foundation of the Master Configuration Index (MCI). The MCI represents the current national configuration of the NAS and is the basis for the CM process relationships. Any changes to the national configuration must undergo formal NCP processing.

4.11.2.2.1.5 Audit Results

Configuration audit results are findings from formal configuration audits, such as functional and physical configuration audits. These findings may result in baseline changes or other actions required to meet baseline or contract requirements.

4.11.2.2.2 Requirements Management

4.11.2.2.2.1 Change Requests

4.11.2.2.2.1.1 NAS Change Proposal (NCP)

The NCP, FAA Form 1800-2, is the vehicle used internally by Requirements Management, Synthesis, Interface Management, and Lifecycle Engineering processes to formally establish or change NAS baselines.

4.11.2.2.2.1.2 Requirements

The NAS system requirements represent the highest level of requirements for the NAS. Lower-level requirements for all new systems must be traceable from the top level. The CM ensures that all tasks required to maintain that traceability are executed.

4.11.2.2.3 Functional Analysis

4.11.2.2.3.1 Architecture

4.11.2.2.3.1.1 Functional Architecture

For the CM process, the Functional Architecture provides a view of how the NAS provides the services detailed in the NAS Architecture.

4.11.2.2.4 Synthesis

4.11.2.2.4.1 Change Requests

4.11.2.2.4.1.1 NAS Change Proposal

The NCP, FAA Form 1800-2, is the vehicle used internally by Requirements Management, Synthesis, Interface Management, and Lifecycle Engineering processes to formally establish or change NAS baselines.

4.11.2.2.4.2 Architecture

4.11.2.2.4.2.1 Physical Architecture

For the CM process, the Physical Architecture provides a view of the physical attributes of the NAS. Specifically, it captures the system elements and associated interactions, requirements traceability, and allocated matrices, which in turn capture the allocation of functional and performance requirements among the system elements.

4.11.2.2.4.3 Configuration Documentation

4.11.2.2.4.3.1 Configuration Item Description

Configuration item (CI) descriptions are introduced to the CM process through change proposals. The affected baseline determines the change vehicle to be used to either establish or update a baseline. CI descriptions are provided with the appropriate change vehicle in the form of listings, and descriptive documentation such as specifications, design documents, drawings, or diagrams.

4.11.2.2.4.3.2 Statements of Work (SOW) and Contract Deliverable Requirements Lists (CDRL)

SOWs and CDRLs are developed through the Synthesis process and detail contract requirements and specific deliverables. The Synthesis process provides SOW and CDRL drafts to CM for inclusion of specific CM requirements and CM-related deliverables.

4.11.2.2.5 Interface Management

4.11.2.2.5.1 Change Requests

4.11.2.2.5.1.1 NAS Change Proposal

The NCP, FAA Form 1800-2, is the vehicle used internally by Requirements Management, Synthesis, Interface Management, and Lifecycle Engineering processes to formally establish or change NAS baselines.

4.11.2.2.6 Lifecycle Engineering

4.11.2.2.6.1 Change Requests

4.11.2.2.6.1.1 NAS Change Proposal

The NCP, FAA Form 1800-2, is the vehicle used internally by Requirements Management, Synthesis, Interface Management, and Lifecycle Engineering processes to formally establish or change NAS baselines.

4.11.2.2.6.2 Configuration Documentation

4.11.2.2.6.2.1 Product Documentation

Product documentation includes those documents that describe the product, such as configuration and interface control drawings, software design documents, version description documents, and technical manuals.

4.11.2.2.6.3 Change Release Notices

CM is a closed-loop process, meaning that a change is not considered closed until actual implementation has been completed. Documentation of completion includes change release notices that specify what has been changed, approval authority, and installation or implementation date. Change release notice information is a key component of configuration status accounting.

4.11.2.2.7 Validation and Verification

4.11.2.2.7.1 Configuration Documentation

4.11.2.2.7.1.1 Test Results

The CM process uses system test results to document completion of product test milestones or to close actions, or as source data during the conduct of formal configuration audits.

4.11.2.2.8 Specialty Engineering

4.11.2.2.8.1 Configuration Documentation

4.11.2.2.8.1.1 Design Analysis Reports

These reports provide information to determine system baseline changes. They contain descriptions of a system's special characteristics, a list of requirements that were either validated or verified during analysis, residual risks, and candidate requirements found as a result of the analysis.

4.11.3 Configuration Management Process Tasks

This section identifies the CM process tasks and highlights the requirements for each activity.

4.11.3.1 Step 1: Plan Configuration Management Process

Planning for configuration management is key to successfully reaching program goals. Planning provides the basis for ensuring application of effective and efficient CM practices throughout each of the applicable SE processes. All planning for CM is discussed in Integrated Technical Planning (Section 4.2). This section describes the primary activities for implementing and maintaining CM.

4.11.3.1.1 Establish and Manage CM Program

CM lifecycle management is the top-level CM activity used to plan and implement the major CM principles over the program lifecycle. It includes planning for, coordinating, and managing all tasks to implement CM principles and to conduct CM activities. CM planning determines the resources for CM activities throughout the lifecycle, establishes the mechanisms to perform the CM process, designates the responsibilities of the organizations performing the CM process, and ensures that control will be extended to vendors and contractors when acquiring equipment.

4.11.3.1.2 Establish a Configuration Control Board

A CCB is the FAA-authorized forum for establishing configuration management baselines and for reviewing and acting on changes to these baselines.

Established by the FAA Administrator as the highest-ranking CCB, the NAS CCB has authority to charter subordinate CCBs as necessary.

The program typically develops its CCB charter and operating procedures upon assignment of a NAS program or programs. Each CCB develops operating procedures in accordance with its specific mission and needs. FAA Order 1800.66, paragraph 3.2.1.5, provides requirements for developing and maintaining CCB charters and operating procedures. Additionally, samples of current CCB charters and operating procedures are on the CM Web page (<http://www.faa.gov/cm/>) or are available by request to the NAS CM organization.

4.11.3.1.3 Develop CM Plans and Processes

CM plans and processes are to be documented. Section 4.2 (Integrated Technical Planning) discusses planning for CM. Additional documents may be useful depending on the complexity of the CM tasks. Refer to FAA Order 1800.66, paragraph 3.2.2.1, for guidance on the specific requirements for CM planning.

4.11.3.1.4 Develop Procurement Requirements for CM

Ensure that CM requirements are included as part of the procurement requirements. Responsibilities are as follows. Through reviews of procurement and planning documentation, determine CM requirements of a proposed procurement. CM deliverables must generally support management of the product during the contract and the maintenance philosophy for the procurement. Ensure that these identified requirements are incorporated into the SOW and are itemized in contract deliverables. Additionally, review proposal responses to determine whether they meet the CM requirements and participate in post-award conferences to ensure common understanding of contract CM requirements among all members and to resolve any issues.

4.11.3.1.5 Establish Work Product Requirements

Establish and maintain requirements on work products and services that result from the process. Work products developed within the program/project requiring management's signature must be configuration managed. Identify work products associated with the program/project and establish requirements for controlling changes to those work products.

4.11.3.2 Step 2: Identify Baseline Elements

Identify associated work products, establish and maintain requirements on work products and services that result from the process, and establish requirements for controlling changes to those work products. Identifying these products provides the means to establish and maintain baselines. Systems/products are identified through SE, Integrated Technical Planning, and Synthesis processes. Key work products requiring management approval or concurrence include concepts of operation, plans, electronic data, and automated support tools.

4.11.3.2.1 Configuration Identification

Configuration identification or product definition is the systematic process of selecting product attributes, organizing associated information about the attributes, and stating those attributes. It includes assigning and applying unique identifiers for the product and its associated documentation, as well as maintaining document revision relationships to the product configurations. Product attributes are applied to hardware, software, firmware, and their associated documentation. These attributes mature through each of the lifecycle phases and, at key milestones during those phases, are validated and incorporated into the baseline.

4.11.3.2.1.1 Selecting Configuration Items

Selecting CIs separates the elements of a system or product into individual subsets to manage their development and subsequent change. Designating CIs for FAA configuration management is usually defined at the major subsystem levels of the work breakdown structure or to critical items, lowest replaceable units (LRU), and releasable software code elements. The process steps for selecting CIs in the FAA are as follows (see FAA Order 1800.66, paragraph 3.3.2.1):

- Establish program and program identification

- Plan acquisition strategy
- Select configuration items
- Update Integrated Program Plan

4.11.3.2.2 Baseline Establishment and Maintenance

The progression of a product through its lifecycle is captured as a baseline. Key product milestones provide a snapshot of the product configuration at the respective lifecycle phase. A baseline is “an agreed-to description of the attributes of a product at a point in time, which serves as a basis for defining change.”² The baseline includes specific revision or version of approved and released documents, sets of documents, or electronic files (software and data) that serve as the basis for managing change. Formal baselines are established at designated times during each of the lifecycle phases, which appear in Figure 4.11-3.

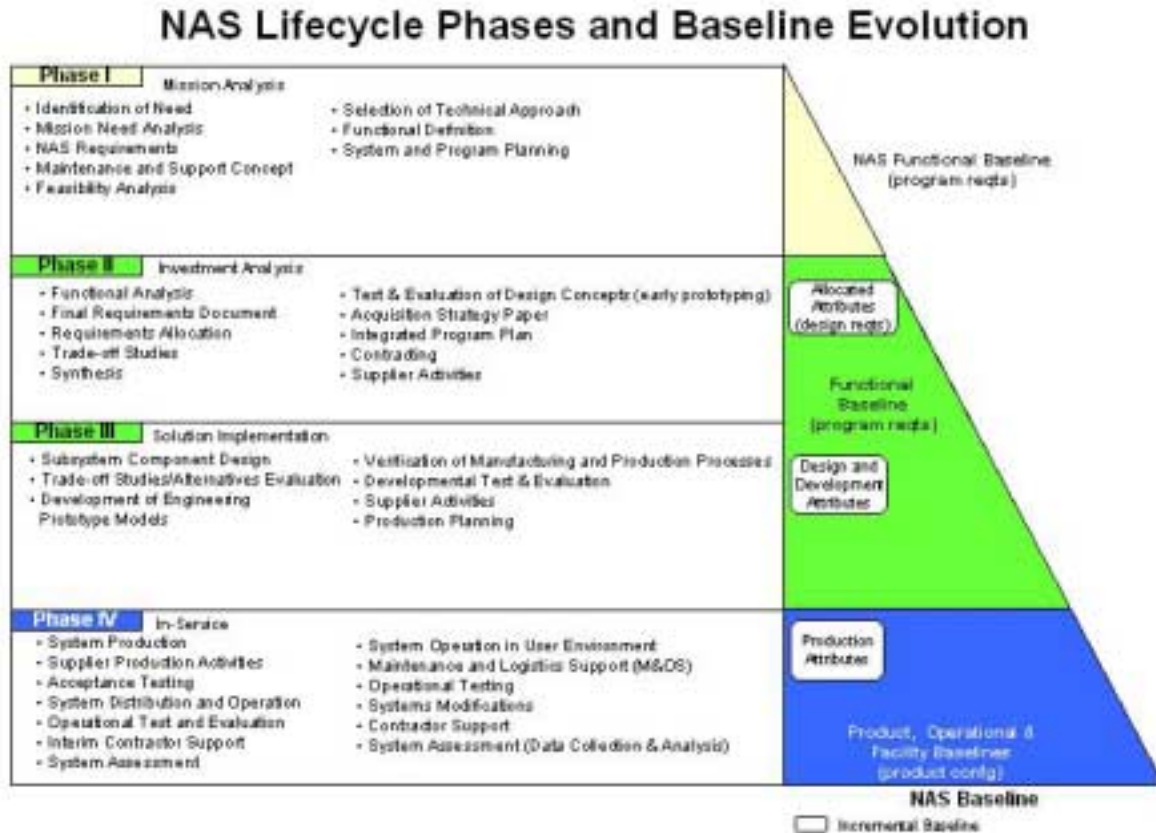


Figure 4.11-3. Product Lifecycle Phases and Baselines

Following are typical baselines that are established for an acquisition program. Because of the complexity of the NAS, the FAA also maintains an enterprise-level or NAS functional baseline, which represents the top-level requirements for the NAS overall.

² ANSI/EIA-649-1998, National Consensus Standard for Configuration Management.

Other FAA unique baselines include the operational and facility baselines that are described below. Figure 4.11-4 represents the product development process and the key CM milestones for baseline establishment and validation.

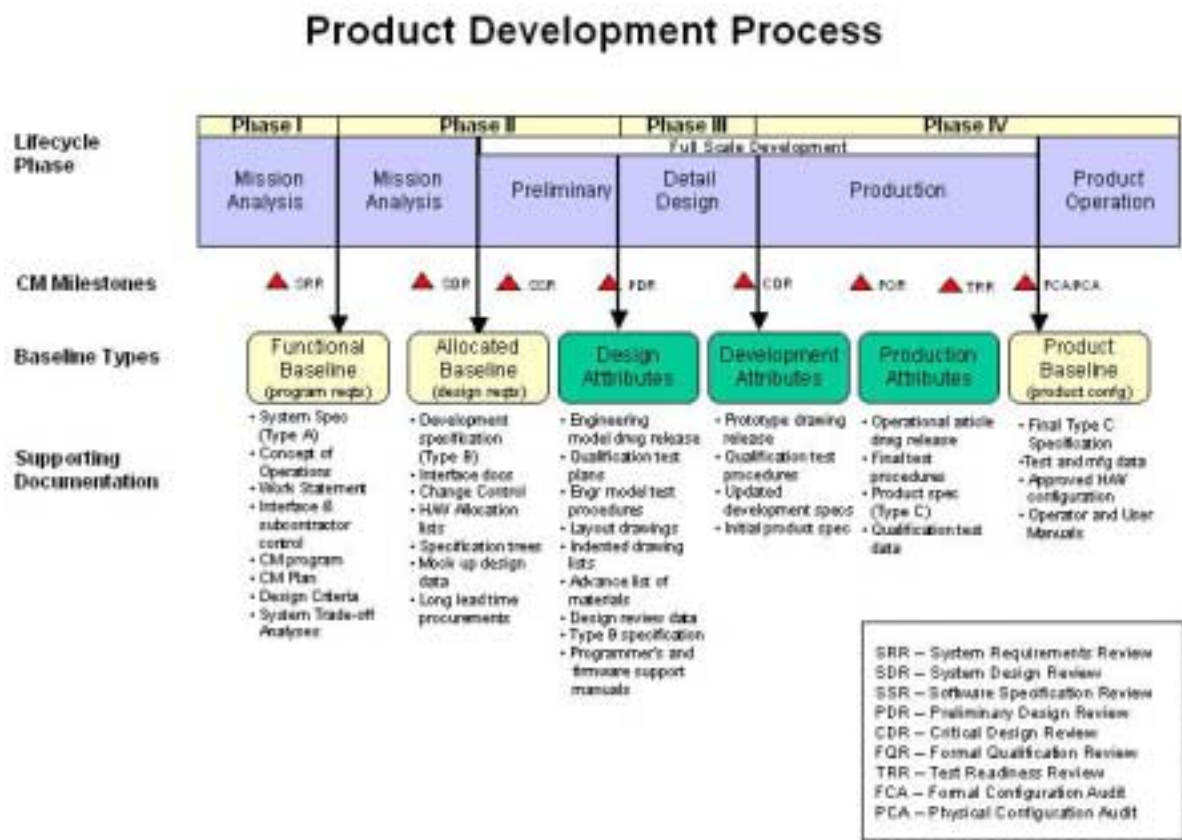


Figure 4.11-4. CM and the Product Development Process

4.11.3.2.2.1 NAS Functional Baseline

The technical portion of the NAS Architecture defines and translates services, capabilities, and implementation steps into design solutions and their required technical characteristics. The technical characteristics are “NAS-Level Requirements” that explicitly translate the operational needs of the agency into functional, performance, and constraint requirements that are sufficient to direct the appropriate design and development of NAS systems. NAS-Level Requirements are the highest-level requirements maintained within the FAA and are initially defined during Investment Analysis. The NAS Functional Baseline is composed of two elements, which are NAS-level requirements and Final Requirements Documents (see FAA Order 1800.66, paragraph 3.3.3.1).

4.11.3.2.2.2 Functional Baseline

The functional baseline represents the functional requirements for a program and is the first formal program baseline to be established after concept exploration. The typical milestone, which must be met before this baseline is established, is successful completion of the system requirements review (SRR). The SSR generally entails review

of analysis and trade study reports used to develop the system/segment requirements. The functional baseline is managed through a formal control process using the change vehicle(s) documented in the developer's approved CM plan and/or the customer's formal change proposal form, if different (e.g., NAS change proposal or NCP form). The customer has final approval authority over changes to the functional baseline.

4.11.3.2.2.3 Allocated Baseline

The allocated baseline represents the design requirements for a program. This baseline is typically established during the system design phase after system design reviews (SDR). The SDR typically entails review of the system/segment specification, concept of operations, preliminary software requirements, interface requirements, and other analyses and trade study reports. Generally, the allocated baseline is managed through a formal control process using the change vehicle(s) documented in the developer's approved CM plan and/or the customer's formal change proposal form. Typically in the FAA, the contractor manages the allocated baseline; however, the FAA has final approval authority over changes.

4.11.3.2.2.4 Product Baseline

The product baseline represents the configuration of the system or product being delivered to the customer. The milestones for establishing this baseline are the performance of formal functional and physical configuration audits (FCA/PCA). FCA is the formal review of final test documentation and test reports, user and operator's manuals, and diagnostic manual. PCA is the formal review of the final Type C product specification, referenced documentation, drawings, software product specification, and version description document. The product baseline is managed through a formal control process using the customer's change vehicle as documented in the customer's organizational CM policy and plan. To manage the product baseline, the FAA uses FAA form 1800-2, NAS Change Proposal (NCP); the program trouble report (PTR), which captures proposed corrective action for software; the and hardware discrepancy report (HDR), which captures proposed corrective action for hardware,

4.11.3.2.2.5 Facility Baseline

As discussed above, the FAA manages the NAS through traditional baselines: functional, allocated, and product. Additionally, the FAA manages the facility baseline. This baseline is an essential element of FAA planning for introducing NAS systems/subsystems. Facility baselines are a major component of the transition planning process, as described in FAA-STD-058, Federal Aviation Administration Standard Practice Facility Configuration Management. The complexities and variety of new projects to be implemented result in competition for floor and/or roof space, electrical power, and environmental and operational resources. Consequently, regional CMPs and CCB charters define space, power, and other resources as CIs that must be managed.

Facility baseline data is the information needed to identify and control changes as well as record configuration and change implementation status of all CIs under Regional CCB authority. There are two important categories of facility data subject to configuration management: facility baseline drawings and engineering data such as critical power panel schedules. Refer to FAA-STD-058, Facility Configuration Management, for specific criteria.

Establishment of a Facility baseline is determined by assessing the impact of Capital Investment Plan projects, as well as regionally and nationally initiated changes and improvements. When required, regional CM personnel generate an NCP to establish the baseline (see FAA Order 1800.66, paragraph 3.3.3.5).

4.11.3.3 Step 3: Manage Approved Baseline Element Changes

Configuration control is the systematic process that ensures that baseline changes are properly identified, documented, evaluated, and approved by the appropriate level of authority and implemented and verified. A change is “any alteration to a product or its released configuration documentation. A configuration change may involve modification of the product, product information and associated interfacing products.”³ The level of control is determined by documented process requirements.

4.11.3.3.1 Identify and Describe Change

Changes to baselines are documented on the applicable change vehicles. In the FAA, any person can identify a problem or suggest an improvement at any time during the product lifecycle. The type or the need for a change vehicle is determined by the type of baseline, who is responsible for controlling the baseline, and the agreed-to CM planning documentation. Change vehicles provide the means to state the problem or need for change, the proposed change, affected CI cost, schedule for implementation, and so forth. Change vehicles are uniquely identified and require the CI (e.g., product identifier and document number) affected. For NAS baseline management, the FAA uses FAA form 1800-2, which represents proposed changes to the form, fit, or function (or Class I type change) of CIs identified as part of the NAS baseline. Program Trouble Reports and Hardware Discrepancy Reports are the vehicles used, primarily by operational support personnel to correct a problem or inconsistency (or Class II type change).

4.11.3.3.2 Evaluate Change

Coordination and review of changes is the systematic approach for ensuring the validity, feasibility, and assessment of impacts of the change. Formal reviews capture each reviewer's name, organization, comments, date of review, and appropriate resolution of comments as applicable. Reviews are required prior to adjudication. This approach includes reviews of changes to both formal and informal baselines (e.g., NAS baseline and work-product baseline changes).

4.11.3.3.3 Approve Change

Change disposition is the conclusion by the appropriate authority that the item submitted for approval is either suitable or unsuitable for implementation or release. CCBs serve as a forum for adjudicating changes for formal baselines.

In the FAA, the CCB structure has an established hierarchy. The NAS CCB is the highest-ranking FAA board and has the authority to charter subordinate Solution Provider, Regional, and other CCBs, such as the William J. Hughes Technical Center CCB. In this role, the NAS CCB has general oversight responsibility for ensuring consistency across all CCBs. The NAS CCB also serves as the appropriate forum to resolve issues elevated from subordinate CCBs. The NAS CCB charter and operating

³ ANSI/EIA-649-1998, National Consensus Standard for Configuration Management.

procedures provide further detail on the relationship and interaction of the NAS CCB with other chartered CCBs.

Each CCB acts as an independent decisionmaking body within its prescribed level of authority. A CCB has decision authority for all changes affecting CIs assigned to the CCB, as listed in Appendix A of its charter as well as any other responsibilities specifically identified in the charter. These CCBs may approve any change as long as the CI is assigned to the CCB and the appropriate source of funding is available when cost impact is involved. In cases where a source of funding is not identified, the CCB must follow agency procedures for obtaining necessary funds (see FAA Order 1800.66, paragraph 3.4.1).

4.11.3.3.4 Monitor Change Implementation

An important function of CM is monitoring change implementation. This activity ensures that approved changes are completed and released in a timely manner.

4.11.3.4 Step 4: Verify and Audit Configuration

Conducting audits and quality checks ensures the integrity of the system or product. The FCA/PCA is a formal audit activity used to establish the product baseline. Quality checks, peer reviews, or internal audits of work products are informal means for documenting and managing the quality and validity of informal organizational baselines.

4.11.3.5 Step 5: Provide Configuration Status

Status accounting is the systematic recording and reporting of system or product configuration status. Configuration status accounting (CSA) includes baseline change status and history from inception to end of product service. CSA reports are used not only to communicate status, but also to support the conduct of formal configuration audits. CSA is performed at all levels of CM through a system or product lifecycle.

4.11.3.5.1 Capture Change Data

Capturing change data, typically by using automated CM support tools, enables recording and reporting of the status and history of baseline changes from initiation through implementation.

4.11.3.6 Step 6: Perform Data Management

Data management includes controlling information in digital format to ensure the integrity of digital representations of system or product information and other related data. Digital data is information prepared and maintained by electronic means and provided by electronic data access, interchange, transfer, or on electronic media. It shall include effective file and database management; unique identification of documents, files, and document representations; retention of essential file and version relationships; data status; and controlled access to digital data. It should be noted that the control of digital data involves applying tailored requirements based on the first five practices (4.11.1 above).

The FAA has a number of policies regarding control of information, and this documentation should be referred to when planning for control of electronic data. If there is no applicable policy, refer to Section 5.6 of EIA 649 to develop criteria. There is, however, documented practice for managing work products within programs. Section

4.11.6, Control of Work Products, addresses management of documentation and sets of data that support a NAS product.

4.11.4 Outputs

4.11.4.1 External

External outputs are information provided to the customer or receiving process that is outside the SE discipline processes. Major external outputs to CM are detailed below.

4.11.4.1.1 Approved Baselines

The CM process provides the mechanism to establish baselines. Baselines are established at completion of each CM milestone shown in Figure 4.11-4.

4.11.4.1.2 Approved Baseline Changes

Baselines are the basis for change. After approval of change requests, applicable baselines are updated to reflect the changed baseline information.

4.11.4.2 Internal

Internal outputs are information provided to the customer or receiving process that is within the SE discipline processes. Major internal outputs to CM are detailed below.

4.11.4.2.1 Requirements Management

4.11.4.2.1.1 Approved Baseline

The CM process provides the mechanism to establish and maintain baselines. After approval by the responsible authority, requirements are to be incorporated into the appropriate baselines.

4.11.4.2.1.2 Configuration Status Accounting Reports

Configuration status accounting reports (CSAR) provide the current status of configuration items or work products. CSARs can be generated electronically and provided on demand or at scheduled intervals by the supporting CM process.

4.11.4.2.2 Synthesis

4.11.4.2.2.1 Approved Baseline

The Synthesis process uses baselines or baseline subsets to manage changes, promote visibility, and communicate status of the baseline or its components.

4.11.4.2.2.2 Approved Baseline Changes

Baselines are the basis for change. After approval of change requests, applicable baselines are updated to reflect the changed baseline information. Both externally and internally provided change requests affect baselines used by the Synthesis process.

4.11.4.2.2.3 Configuration Status Accounting Reports

CSARs provide the current status of configuration items or work products. They can be generated electronically and provided on demand or at scheduled intervals by the supporting CM process.

4.11.4.2.3 Risk Management

4.11.4.2.3.1 Approved Baseline

Informal, approved work-product baselines for the Risk Management process are established and approved through the Risk Management process in accordance with the process participants documented plan. The Risk Management process may also use the current NAS baseline or a baseline subset to assist in program assessments.

4.11.4.2.3.2 Approved Baseline Changes

Changes to informal, approved work product baselines for the Risk Management process are established and approved through the Risk Management process. The Risk Management process may also use the current NAS baseline or a baseline subset to assist in program assessments.

4.11.4.2.3.3 Concerns and Issues

Program or system concerns and issues found during the CM process are outputs to the Risk Management process. These concerns and issues are typically found during review of changes or at the CCB meeting and require resolution outside of the CM process.

4.11.4.2.3.4 Configuration Status Accounting Reports

CSARs provide the current status of CI or work products. They can be generated electronically and provided on demand or at scheduled intervals by the supporting CM process.

4.11.4.2.4 Lifecycle Engineering

4.11.4.2.4.1 Approved Baseline

The Lifecycle Engineering process uses baselines or baseline subsets to manage changes, promote visibility, and communicate status of the baseline or its components.

4.11.4.2.4.2 Approved Baseline Changes

Baselines are the basis for change. After approval of change requests, applicable baselines are updated to reflect the changed baseline information. Both externally and internally provided change requests affect baselines used by the Lifecycle Engineering process.

4.11.4.2.4.3 Configuration Status Accounting Reports

The CM process provides the Validation and Verification process with CSARs that communicate the status of the current baseline including associated change history. CSARs are used during formal audit and independent validation and verification activities, which ensures that the product meets the documented requirements. CSARs

are used specifically to validate configuration documentation and consistency between a product and its associated configuration documentation and to determine that an adequate CM process is in place to provide continuing control of the configuration.

4.11.4.2.5 Validation and Verification

4.11.4.2.5.1 Approved Baseline

The Validation and Verification process uses baselines or baseline subsets to perform audits and quality checks or to monitor system changes and to promote visibility of baseline status or its components.

4.11.4.2.5.2 Approved Baseline Changes

After approval of change requests, applicable baselines are updated to reflect the changed baseline information. Both externally and internally provided change requests affect baselines used by the Validation and Verification process.

4.11.4.2.5.3 Configuration Status Accounting Reports

The CM process provides the Validation and Verification process with CSARs that communicate the status of the current baseline, including associated change history. CSARs are used during formal audit and independent validation and verification activities, which ensures that the product meets the documented requirements. CSARs are used specifically to validate configuration documentation and consistency between a product and its associated configuration documentation and to determine that an adequate CM process is in place to provide continuing control of the configuration.

4.11.4.2.6 Integrated Technical Management

4.11.4.2.6.1 Planning Criteria

The CM process receives as input requests for information. Integrated Technical Planning receives from the CM process CM planning criteria for such documents as Acquisition Strategy Papers and Integrated Program Plans.

4.11.4.2.7 Interface Management

4.11.4.2.7.1 Approved Baseline

The Interface Management process uses baselines or baseline subsets to manage changes to system interfaces, promote visibility, and communicate status of the baseline or its components.

4.11.4.2.7.2 Approved Baseline Changes

After approval of change requests, applicable baselines are updated to reflect the changed baseline information. Both externally and internally provided change requests affect baselines used by the Interface Management process.

4.11.4.2.7.3 Configuration Status Account Reports

CSARs provide the current status of CIs or work products. They are generated electronically and provided upon demand or at scheduled intervals by the supporting CM process.

4.11.4.2.8 Specialty Engineering

4.11.4.2.8.1 Approved Baseline

The Specialty Engineering process uses baselines or baseline subsets to support analysis of systems or associated components. The baseline is the basis for any changes, such as design features, operating maintenance, or installation procedures.

4.11.4.2.8.2 Approved Baseline Changes

After approval of change requests, applicable baselines are updated to reflect the changed baseline information. Both externally and internally provided change requests affect baselines used by Specialty Engineering process.

4.11.4.2.9 Integrity of Analyses

4.11.4.2.9.1 Approved Baseline

The Integrity of Analyses process uses approved baseline to support the appropriate application of the required level of fidelity, accuracy, and confirmed results of analyses performed by other SE processes.

4.11.4.2.9.2 Approved Baseline Changes

The Integrity of Analyses process uses approved baselines changes to support review of analyses performed by other System Engineering processes.

4.11.5 Configuration Metrics

CM process metrics support evaluation of the effectiveness of a CM program and CM process-improvement requirements. Metrics criteria for CM should be associated with each CM process task. For instance, in CM planning, CM plan development milestones, quality completeness, and adherence to the plan can be measured. The metrics should support the program goals and provide good insight to process improvements.

4.11.6 Control of Work Products

4.11.6.1 Introduction

In the context of managing NAS products or systems, work products are supporting products of the NAS, while not formally part of a NAS product's configuration. CM of key work products identified should be applied consistently throughout the organization. Key work products are derived from the AMS and as determined by the project Leader. Key work products include, but are not limited to, the required AMS documentation (e.g., Program Implementation Strategy), requirements, contract documentation, CCB charters and operating procedures, plans, policies, procedures, and formal meeting minutes.

As with any CM activity, work product procedures should be documented and included in planning documentation to ensure consistency and quality of work products.

4.11.6.2 Identification of Work Products To Be Controlled

In accordance with agency or organizational policy or practices, each work product must be assigned a unique identifier and tracked using version or revision levels (including preliminary versions and drafts). File-naming conventions are to be consistent and easily traceable to the product title.

4.11.6.3 Control of Work Products

Formal review and version control of identified key work products are required to ensure accuracy, completeness, and traceability of changes. Key work products and associated change history are to be maintained in the program support library (PSL).

Each person responsible for preparation of a product is to perform version control for each key work product.

Electronic files are to be maintained to allow traceability to historical records of individual files. Each new version or revision of a file must have its own unique identifier. The original file will not be overwritten. Suggested minimum format for working versions would be, for example, ara_cmp_v1.1, ara_cmp_v1.2, ara_cmp_v1.3 and so forth for revisions to the original ara_cmp_v1.0.

Work product revisions requiring signature for formal release should begin, for example, at version 1.0 or revision 0 for the initial release of a document. The next revision for that document released for signature would be submitted as version 2.0 or revision A. (Versions 1.2, 1.3, 1.4, etc., indicate a working review copy.)

4.11.6.4 Perform Quality Checks

Before being signed or released, key work products must be processed through quality assurance and/or peer review. Proof of quality assurance and/or peer review is to be maintained with the work product housed in the PSL.

4.11.7 References

1. Blanchard, B. *System Engineering Management*. Second Edition. John Wiley & Sons, Inc., 1998.
2. Electronic Industries Alliance. *National Consensus Standard for Configuration Management*. EIA-649. Arlington, VA: Electronic Industries Alliance, August 1998.
3. Federal Aviation Administration, *National Airspace System Configuration Management Policy*. FAA Order 1800.66. Washington, DC: U.S. Department of Transportation, Federal Aviation Administration, January 1999.
4. Samaras, Thomas. *Configuration Management Deskbook*. Advanced Applications Consultants, Inc., 1988.